the species by written characters or descriptions is beyond my powers. But no one has ever seen so many of the type-specimens of the species as I have, nor given more time to the systematic study of these genera. * * *

"It is noticeable that the herbarium of Nees von Esenbeck for Aster is not referred to. *I cannot ascertain what has become of it.* But the types of several of his species, or specimens named by him, have been met with in other herbaria, especially in that of Lindley, and that of Schultz, Bip., the latter now a part of the large collection of Dr. Cosson. As to Asters, I do not here attempt anything beyond a report of the main results of the study of certain principal herbaria; and I leave the high northern and far western species out of the present view."

ZOÖLOGY.

HABITS OF FRESH-WATER CRUSTACEA.—No one branch of biological study is now bringing forth more interesting and every way useful results than embryology. Throwing light as it does, not only on questions of classification and theoretical biology, but also on the application of such theories to practical life, this new science may be termed at once the root and most typical fruit of a revolutionized biology. No other science furnishes a better illustration of the value of minute, accurate study of the most common and apparently insignificant facts. Sets of isolated facts evolved by conscientious study of different men spring suddenly into line when once the clue is found, and the result may be a new law which renders all these facts eloquent.

To the systematist the merely external study of life histories is of greatest value as a check against redundancy in classification, and furnishes the only reliable method, among lower forms at least, of setting the bounds of species.

Many eminent monographers have been obliged to considerably augment the nomenclature of their specialty with names which, later, have proved to apply simply to larval or immature forms, on account of the impossibility of following the whole life history of each individual.

To confine ourselves to the class Crustacea, many instances of this sort could be recounted. The best known is perhaps that of the common Cyclops which in the earlier days of carcinology enjoyed as many as three names between its exclusion from the egg and maturity. The discovery of the earlier stages in the life of Cyclops opened a new vista in the whole subject, and now we recognize a "*Nauplius stage*" in the life-history of nearly every crustacean.

It has been more recently discovered that similar opportunities for error are afforded by the difficulty of distinguishing the ultimate stage in an animal's life. It has been shown that the functions of reproduction are anomalous in the lower animals. Espe-

cially is this true in Crustacea, in so much that their condition affords no sufficient evidence that the sexually mature animal is in its historically perfect form. The enthusiasm elicited by the discovery that certain amphibians, under some circumstances, reproduce during a larval stage, was almost unparalleled, but I believe it demonstrable that, not only species, but families of lower Crustacea are normally sexually mature in a stage preceding actual maturity.

We most naturally turn to the order Branchiopoda for a test, since the most remarkable cases on record of heterogeneous reproduction have recently been read in their history. We need only mention the parthenogenetic summer brood of Daphnia,[1] and the case of heterogenesis discovered by G. O. Sars in Leptodora,[2] in which Sars concludes that *L. hyalina* has both "dimorphous development and alternation of generations." Nor are we disappointed in looking among the Cladocera for examples of heterogenesis. During the winter semester of 1881–82, at Leipzig University, we had the opportunity of studying the development of *Daphnia magna* (=*schäfferi*), and among other interesting facts the following were elicited:

The development proceeds in very much the way described for Moina by Grobben.[3] The secondary or swimming antennæ have an evident palpus in the nauplius stage, however, which makes the parallel complete between Copepod and Branchipod Crustacea. The heart and circulatory system apparently is formed differently from the method given by Grobben. I may be permitted to say in this connection, that the circulatory system is much more complicated than hitherto described, and seems to originate about a mass of deutoplasm which surrounds the intestinal canal in the embryo, and which is a remainder of the food-yolk, "*Nährungsdotter*," of the egg. The embryo, in a comparatively early age, begins to differentiate the walls of the valves, which first appear as a fold over the maxillary region near the position occupied by the heart, and extends gradually backwards in a thick fold of turgid cells between which fluid flows. Quite remarkable is it that from the dorsal region a process extends, growing much more rapidly than the lateral portion till it reaches the membrane of the egg, when it curves downward and forwards till it reaches a position nearly half way from the extremity of the abdomen to the maxillæ. The method of growth of this tail-like appendage of the shell is obscure, but it seems to stand in close relation to the formation of the brood-

[1] See J. Lubbock; Phil. Trans., Vol. 147, p. 98.
Cfr. R. Leuckart: Archiv. f. Naturg., XXXI, and
v. Siebold: Wahre Parthenogenesis bei Schmetterlingen und Bienen.

[2] G. O. Sars: Om en dimorph Udvikling samt Generations vexel hos Leptodora, 1873.

[3] Die Entwicklungeschichte der *Moina rectirostris*, von Dr. Carl Grobben. Vienna, 1879.

cavity, and is the result of a secondary folding of the common shell envelop. At the close of the development in the egg, this "tail" lies between the valves of the shell, curved beneath like the tail of a frightened dog, although the frequent motions of the post-abdomen are not a little hindered thereby.

On its escape from the egg, the animal swims freely, and soon kicks this pliant appendage backward and upward till it assumes a direction parallel to the long axis of the body, and then very soon its unequal growth causes this tail to be somewhat elevated. The appendage probably serves as a support for the cast off skin in the molt, so that it cannot fall down upon the post-abdomen and then be broken off before that portion of the shell forming the inner covering of the brood cavity can be successfully molted —a danger especially incident to long forms with narrow brood cavities, and to young animals in which the shell is tender. (It may be for this reason that males, in which the part corresponding to the brood cavity is very narrow, and young females, have this spine, while adult females do not, for, as is well known, the males of all this section of the genus are spined through life.) Successive moltings increase the size of the animal, but the spine remains and increases correspondingly, giving the animal a very different appearance from the parent, which was not only of an entirely different form but totally without the spine.

Finally the young female produces eggs parthenogenetically, and is, therefore, according to our customary notions, an adult. We have here, therefore, a case of heterogenesis. Under circumstances where food is not sufficiently abundant, it seems certain that the above-mentioned state is the final one, and that the animal does not reach that condition which we name *Daphnia magna*, but remains in a stage which has received a different specific name.

The same process has since been observed in the case of *Daphnia pulex*, in Minnesota. Some of the so-called varieties are but age-forms. There is in each species what may be called a *post-imago* form, which is only assumed under favoring conditions. Without going into the synonymy of this genus, which will bear a revision in view of this and similar facts, we may safely say that in the Daphnidæ we find heterogenesis almost a rule, at least in the genus Daphnia.[1] We may add that every possible provision for the reproduction of these animals seems to be provided. (1) They are very prolific; (2) reproduce both sexually and parthenogenetically; (3) resist great extremes of temperature; (4) accommodate themselves to great alterations in the purity of the water; (5) the winter eggs are provided with a horny covering or *ephippium*, which permits them to be dried in a mass of mud or frozen in a cake of ice without destroying their vitality; (6)

[1] See Birge, Notes on Cladocera, Madison, Plate II, Fig. 6.

during mild winters both summer and winter eggs are produced, and the successive broods of young after producing agamic young, throw off an ephippium so that the pool is filled with eggs which are calculated to stand any vicissitude. Thus it happens that after a pond has been dried for a long time the first warm shower quickens in it swarming life. The above facts are more significant when we remember that the Cladocera are above all others among Crustacea, the most useful as purifying agencies. The greater number subsist entirely upon vegetable matter, and the only means they have of collecting it is by causing a current of water containing such minute particles as may exist in it to pass between the rotating jaws, though, perhaps, in some cases the labrum is sufficiently prehensile to grasp somewhat larger food. Certain it is, however, that these same minute animals form an indispensable agent in the economy of nature, purifying all our stagnant pools of the decaying vegetation floating therein. One who had given no attention to the number of these creatures would undoubtedly be surprised on carefully examining a given quantity of water from the nearest lake. Here are some figures.

In a quart of water taken by dipping from a lake near Minneapolis, the following were counted:

Ceriodaphnia	1400
Daphnia	9
Simocephalus	56
Cypris	50
Cyclops	28
Amphipods (chiefly young)	120
Infusoria	35
Mollusks	22
Diptera (larvæ)	100
Hemiptera	9

etc., all visible to the unassisted eye.—*C. L. Herrick.*

On the Habits of Cryptobranchus.[1]—Living examples of this Japanese salamander have rarely been brought to this country, and the following observations may be worth recording even if they merely confirm those of Hyrtl, Van der Hoeven and others, whose works I have not yet had an opportunity to consult.

This specimen is about seventy-five centimeters (2½ ft.) long, and was obtained for Cornell University through Professor H. A. Ward, who brought it by hand from Japan.

It is very sluggish, remaining quiet for hours in water, excepting for the respiratory movements presently to be described. Nevertheless it can display considerable activity, and upon one occasion escaped from a common wash-tub which was about thirty centimeters (1 ft.) deep. Out of water it appears uncomfortable, and crawls first in one direction and then in another,

[1] Read at the Montreal Meeting of Amer. Association for Advancement Science, August, 1882.

with frequent stoppages. It evidently seeks shelter from the sun, but gives no sign of discrimination between objects, walking against dogs and cats and people as readily as against wood and stone. The trunk is never lifted from the ground, and the compressed tail rests on one side, but the head and neck are sometimes raised.

The respiratory actions in deep water I have not accurately observed, but in shallow water, just covering it, the nostrils are raised above the surface at frequent intervals, a slight hissing sound is heard, and after the nostrils are again carried below the surface, a few bubbles of air escape therefrom and there are muscular movements about the neck. During an hour, in freshly changed water, these respiratory actions occurred at intervals varying from half a minute to twelve minutes, but usually the time was from two to four minutes.

No notice was taken of raw or cooked beef or fish, either floating at the surface, lying at the bottom or suspended just above the water.

But if bits of food are dropped close to the mouth or allowed to slide over the top of the head, or held at the lips, they are readily snapped up and swallowed, if not too large. After a time the head was moved slowly toward meat held about one centimeter from the lips, but I could not determine whether sight or smell were the sense concerned. Neither have I ascertained the function of the tubercles.

This specimen has now eaten the following articles: Beef heart, raw and boiled; blue-fish, raw and broiled; hard boiled white of egg, canned roast beef, raw lamb's heart, liver, diaphragm, thymus and lung, baked maccaroni. Evidently there is no difficulty in keeping the animal alive.

I hope to make careful observations of Cryptobranchus in comparison with Menopoma and Menobranchus.—*B. G. Wilder, Ithaca, N. Y.*[1]

Mammals of New Guinea.[2]—The Annals of the Museum of Natural History, Genoa, for 1880–81, contain a list of fifty-seven species of mammals collected in New Guinea by L. M. D'Albertis and A. A. Bruijn, illustrated with fourteen plates of new species.

The work of identification and description has been performed by Dr. Peters, director of the Berlin Museum, and G. Doria, director of that of Genoa.

In their introduction these gentlemen state that the Australian element in the New Guinea fauna is continually on the increase, as evidenced by the late discovery in that island of the genera *Tachyglossus*, *Dasyurus* and *Dromicia*. Thirty species of marsupials, forming almost the half of the known mammals of Papua, have been found, and, although almost all the species are peculiar,

[1] The habits of this species are described by Duméril and Bibron, Herpetologie Generale, IX, 1854, p. 165.

[2] Annali del Museo Civico di Storia Naturale di Genova, Vol. XVI, 1880–81.

they yet belong to Australian genera. Twenty-two species of marsupials are included in the list. Those described by our authors are *Phascogale dorsalis*, *P. pilicauda*, *Perameles rufescens*, *P. arvensis*, *P. longicauda*, *Phalangista angustivittis*, *P. Albertisii*, *P. pinnata*, *P. gymnotis*, and *Macropus papuanus*.

It is remarked that the genus *Phascogale* evidently takes the place in Papuasia of the insectivorous genus *Tupaia* of Malaysia. There is no pouch in this genus, and the females of the two new species differ in the number of their mammæ, of which *P. dorsalis* has four, *P. pilicauda* six. Six species of this genus are now known to inhabit the region.

Perameles rufescens is comparatively large, measuring 52 centimetres (1.'–9") in total length. Five species of this genus are known to be Papuasian.

The genus *Phalangista*, as understood by our authors, includes *Dactylopsila*, *Pseudochirus*, *Distoechurus* (Peters), and *Cuscus*. Eight species are enumerated. *P. Albertisii* is a fine species, about 14 inches long, excluding the prehensile tail, which exceeds a foot in length; it is reddish-brown, shaded with black above, with an indistinctly-bounded black band along the back. *P. pennata* is of about the size of a dormouse, or smaller than a rat. In color this pretty little creature is yellowish-brown with two black bands passing from the forehead through each eye to the muzzle. The tail is naked above and below, but bears on its margins long hairs, causing the whole to resemble a feather. An adult female had a well developed pouch, containing a single young one; the mammæ were only two.

P. gymnotis is remarkable for its naked ears and short fur, and is less arboreal than its congeners. In size it exceeds *P. Albertisii*, as it is about a yard in total length. It is stated that *P. trivirgata* Gray, is found by Dr. Albertis to be entirely insectivorous instead of frugivorous, as was asserted by Wallace.

Only three examples of *Macropus papuanus* were taken, and unfortunately the skulls belonging to the two larger skins were lost, but the length of the sole of the hind feet was 10 inches, and D'Albertis asserts that it attains a stature but little inferior to that of *M. giganteus*. *Macropus Bruni* of Schlegel inhabits the islands Aru and Kei, while *Dorcopsis Müllerí* Schlegel, is found with *P. papuanus* on the eastern coast of New Guinea. The remaining kangaroos of the region are *Dorcopsis luctuosus* (D'Albertis) and two species of the tree-inhabiting genus *Dendrolagus*.

The discovery of the monotreme, *Tachyglossus Bruijnii*, described by Peters and Doria in 1876, is one of the most important in the field of geographical distribution, that had been made for several years. The French explorer, Leon Laglaize, has since procured some examples at a height of about 3500 feet above the sea-level, in the Karon mountains of New Guinea. The natives call it "Nokdiak" and chase it with dogs that follow it into its

deep burrows. Professor Gervais, after a study of this animal, has founded for it the genus *Acanthoglossus* on account of the spines at the tip of the tongue. In 1877, *Tachyglossus (Echidna) Lawesii* was described by L. P. Ramsay, of Sydney, from an example taken by the Rev. Mr. Lawes at Port Moresby. *T. Bruijnii* of the north of New Guinea, is near *T. setosus* of Australia, while *T. Lawesii* is the representative of the Australian *T. hystrix*.

Nineteen species of Cheiroptera are enumerated, and two others are known. Among these *Emballonura Beccarii* and *Vespertugo papuanus* are new. Many of the bats are Malaysian, Australian or Polynesian.

The only insectivore of the Papuan group, *Crocidura luzoniensis* (Peters), was probably introduced from the Molluccas; and to introduction New Guinea probably owes its single wild ungulate, *Sus papuensis* (Lesson).

Among the thirteen rodents of the list the cosmopolitan *Mus rattus* and *Mus decumanus* find a place, followed by six others of the same genus, four of *Uromys* (Peters) and one of *Hydromys* (Geoffroy).

Results of the Voyage of the Magenta.—Prof. A. T. Tozzetti, of the Museum of Florence, has published a list of the Brachyura obtained by the Italian frigate *Magenta* in its circumnavigation of the world. The list includes sixty-three species.

The same naturalist contributes valuable notes upon the Mediterranean cephalopods. Thirty-one species of Dibranchiata are enumerated, with many additional particulars respecting their distribution and habits. The hectocotyle of *Parasira tuberculata* Tozzetti (=*Octopus violaceus* Risso) contains a single spermatophore in the form of a filament rolled upon itself. This takes the place of the many smaller spermatophores of ordinary cephalopods. *Octopus troscheli* is a new species differing from *O. vulgaris* in dimensions, proportion of arms and body, and disposition of the acetabula. Other new species are *Octopus incertus*, *Sepiola major* and *Rossia panceri*. *Ornitholepus australis* a small pedunculated cirriped living upon the ends of the abdominal feathers of a puffin, *Priofinus cinereus*, has also been lately described by Professor Tozzetti. Nearly a hundred of these birds were taken by the *Magenta* in the South Atlantic and Indian ocean, and all were infested with this parasite upon the barbs and barbules of the central abdominal feathers, while those taken in the Pacific were free from it. The strangeness of this parasitism is heightened by the fact, that *Priofinus* is one of the most ærial of birds, only resting upon the water at long intervals. None of the other Procellaridæ taken in the same regions harbored a cirriped, but all the species were well supplied with Anoplura of the genera *Lipurus* and *Docophoroides*.

THE INK-BAG OF THE CEPHALOPODA.—The researches of M. Paul Girod upon a great number of Cephalopods of the North sea and the Mediterranean, researches carried on in several successive sojourns at Roscoff and Banyuls, have elucidated many points in the anatomy, physiology and development of the ink-bag of those mollusks. The ink-bag is a long, black, pyriform sac opening at the summit of a papilla upon the posterior lip of the anus, and consists of a large reservoir, and of an ink-gland attached to the posterior face of the reservoir, and communicating with it by means of a small round orifice at its upper part. This description differs from that of preceding naturalists, whose statements are to the effect that the secretory apparatus consists of a reservoir whose walls are thrown into folds circumscribing spaces which pour the products of secretion directly into it. In the decapods the gland is free and projects into the ink-sac, but in the octopods the walls of the glands are united for much of their extent with the wall of the reservoir.

Ink-sac and gland are enclosed in a common envelope, consisting of an external tunic of conjunctive tissue; a middle tunic composed of a bed of smooth transverse muscular fibers crossed by a layer of horizontal fibers, and succeeded by a layer of pigment cells; and an internal tunic constituting the special membranes of the gland and reservoir. At the mouth of the sac is a terminal ampulla, bounded at each end by a thickening of the conjunctive tissue of the wall of the sac with a corresponding ring of muscular fibers from the transverse layer, thus forming a double sphincter.

The ink-sac is lined with pigmented pavement epithelium, except the terminal ampulla, which is lined with cylindrical epithelium similar to that of the epidermis of cephalopods.

The gland is composed of undulating lamellæ, leaving between them spaces of variable form. These lamellæ, flat near the orifice of the gland, become concave as they recede from it, and thus form concentric cups enveloping a central whitish mass (formative zone), and becoming of a more vivid black as they are more distant from the center. Analysis of the black secretion proves it to consist of 60 parts of water, 30.5 parts of organic insoluble matters, a little less than one part of soluble organic matters, and 8.6 parts of soluble and insoluble mineral substances. Among the soluble inorganic matters are carbonic acid and the sulphates and chlorides of sodium, potassium, magnesium and lime, while among the insoluble matters are carbonate of lime, magnesia and peroxide of iron. Iron and copper are both present in the blood of the Cephalopoda, the latter metal as a component of hemocyanine, which plays in these creatures the role of hemoglobine in vertebrates. In the soluble organic matters neither urine, uric acid, xanthine nor guanine can be detected, so that the gland is proved not to be a depuratory urinary organ.

The greatest portion of the black pigment consists of an insoluble organic matter to which Bizzio has given the name of *melaine*, and the composition of which greatly resembles that of the pigment of vertebrates.

At the thirteenth day of the development of a cephalopod the anal invagination forms. This increases and divides into the ink-bag and rectum. The cellules at the blind extremity of the growing ink-bag multiply and form a thickening which is the commencement of the ink-gland. The study of the tissues and development of the ink-bag proves that the epithelium of ink-sac and gland is a continuation of the epidermis, and that the wall of the bag is a cutaneous fold.

M. H. de Lacaze-Duthiers has discovered and described in the gasteropods a gland secreting a pigment and having the strictest relations with the rectum, opening into the anus and closely applied to the end of the digestive tube. This anal gland is in relation to another gland (*glande pupurigène*) supplied at once with venous blood, and with venous blood that has passed through the renal body. A gland with a vascular distribution identical with the latter gland of the gasteropods, and with similar nervous connections, has been discovered in the cephalopods between the ink-bag and the gills, and thus M. Girod is impelled to admit the homology of the anal gland of the gasteropods with the ink-bag of the cephalopods.

Zoological Notes.—The Smithsonian Report for 1880 contains much interesting information relative to work done in connection with the National Museum, and concludes with a record of scientific progress, containing among other reviews, that of Dr. Theo. Gill upon zoölogy and of O. T. Mason on anthropology.——Dr. J. G. Fischer (Bonn, 1882) publishes some notes on the collection of snakes in the Royal Museum at Dresden, and descriptions of four new species of lizards from Australia, three of them without fore feet, and two of them types of new genera.——Dr. E. L. Trouessart gives a synoptic revision of the genus Semnopithecus, in which he recognizes thirty-one species.——Recent issues of the Bulletin of the Fish Commission contain a republished article upon the food of the shad, by E. R. Mordecai, M.D. The writer claims the discovery that shad feed and fatten on marine fuci. Also observations upon the development of the silver gar (*Belone longirostris*), by J. A. Ryder; on the cod and halibut fisheries near the Shumagin islands, by Dr. Krause; and a most valuable and exhaustive essay upon Oceanic Protozoa, considered as food for higher organisms, by J. A. Ryder. The entomostracous Crustacea are the great feeders upon the Protozoa, and in their turn furnish food for fishes. The writer always found the remains of food in the intestines, and once in the stomach of shad that were in fresh water. The food consisted of Entomostraca, larger Crustacea and Algæ.——Among other

matters the Proceedings of the U. S. National Museum contains a description of two new races of *Myadestes obscurus*, inhabiting respectively Southwestern Mexico and Guatemala, and the Tres Marias islands, by Leonhard Stegneger, and in the same Proceedings Mr. R. Ridgway describes two new Costa Rican birds, a new fly-catcher and a supposed new petrel from the Sandwich islands, a new owl from Porto Rico, and two new thrushes from this country, one from the Rocky mountains, the other breeding in New York.——The same Proceedings contain much ichthyological news, including a paper by Professor G. B. Goode on Benthodesmus, a new genus of deep-sea Trichiuridæ, allied to Lepidopus. The species was first described as *Lepidopus elongatus*, by F. E. Clarke, from examples taken in New Zealand, and has since been found on the Great Bank of Newfoundland. Messrs. Jordan and Gilbert publish a key to the species of Pomudasys (= Pristipoma) known to inhabit the Pacific coast of tropical America, eighteen in all, including *P. cæsius*, a new species, and describe thirty-eight new species of fishes from Mazatlan, and one from San Salvador. The genus Stolephorus (Engraulis) receives four additions, Tylosaurus (Belone) two, Gobiesox four, Muræna two, Ophichthys two, Lutjanus two. Among the features of the collection described was a specimen of a Malthe and one of Fierasfer, both new. Dr. T. H. Bean gives notes upon a collection of fishes, with descriptions of new species and of a new genus (Delolepis). In the same proceedings Dr. R. W. Shufeldt gives some valuable remarks upon the osteology of *Opheosaurus ventralis*.

ENTOMOLOGY.[1]

BUFFALO TREE-HOPPER INJURIOUS TO POTATOES.—Some years ago we gave a short account of the transformations of this insect (5th Report on the Insects of Missouri, pp. 119–125). The Buffalo tree-hopper (*Ceresa bubalus* Fabr.) oviposits in young twigs of apple, pear and other trees, subsisting in its later stages upon the sap of these trees. It is a very common and widely distributed insect, but does become injurious to a serious extent. We were greatly surprised, therefore, by the recent receipt of a number of specimens from Mr. W. M. Heilman, of Annville, Pa., accompanied by the following note dated July 19th: "I mail you to-day a box of insects injurious to potato plants, and plants showing their *modus operandi*. The insects are probably a species of tree-hopper, and it seems strange to me that they should work on potatoes. They commenced work on potatoes in a young orchard about four weeks ago, and I have not found that they work or do any injury after their last molt or when they become winged. They averaged about fifteen specimens to the

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.